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ABSTRACT

The Departmental Enrollment Projection Model (DEPM), which is based on the assumption that enrollments are essentially influenced by economic and social forces, is described. Under the model's approach, the department, rather than the institution as a whole, is seen as the focal point of both the enrollment projection and, by implication, the planning strategies. The pool of students individual departments are now concerned with is that of potential students, in the relevant higher-education region, contemplating formal training. Quality of education, placement prospects, and relative tuition are factors which can now be directly related to enrollment and controlled in the attainment of institutional and departmental goals. Labor market and education market factors form the economic foundations of the model. The current version of the DEPM has been developed as a recursive system of four behavioral, one trend, and one policy or control equations for each program or department of instruction. Restrictively, each department's direct enrollments are assumed to be independent from the other departments. Equations used in the model are presented and discussed. The data concepts and sources of information used in the model are summarized. The effect of specification, exogenous variables, and policy variations are also described. (SC)

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# DEPARTMENTAL ENROLLMENT PROJECTION MODEL

# DEPM*

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## I. INTRODUCTION

Program enrollments are determined by a variety of social, economic and demographic factors. The projection approaches predominantly in use are supply or demographically oriented,(See (10); (11), and specially (13) in reference to New Jersey efforts.) According to these methodologies, enrollments are derived using cohort analysis: successive generations are followed as they participate in the various educational activities throughout their lives. Implicitly, demand or economic-growth factors are assumed to be essentially accommodating, rather than leading or interactive. Distinctively, the DEPM takes the complementary point of view that enrollments are essentially influenced by economic and social forces. Occupational requirements as well as social expectations -- the latter considered to be fairly stable over short periods of time -- provide potential maxima to degrees conferred, which in turn are contained in enrollment totals (See (2); (9).) In this connection, cohort participation rates, assumed to remain relatively constant under the demographic approaches, become variable, and supply factors are expected to be basically accommodating.

Although the DEPM alters the econometric perspective of the problem at hand, it should be emphasized that both the supply and demand approaches must be understood as complementary. Their respective empirical validity will

obviously depend upon the dynamic interactions set in motion. For instance, near equilibrium and for relatively short periods, the predictive ability of either the supply or demand methodology will not be impaired. However, as the projection horizon is lengthened, it becomes important to allow all of the factors impinging upon enrollment to interact in its determination, (See (9); (17).)

The management implications of the DEPM approach are both distinctive and important. The managerial opportunities open to departments due to the changed projections and consequent planning approach are novel and large. This point may be clarified by contrast. The demographic approach derives a department s share of enrollment as a fairly stable fraction of the total student pool available to an institution. In a subtle way, this procedure may imply a zero-sum game strategy: changes in participation rates for any given department will be viewed as portending opposite adjustments for the others. Chairmen, in this context will appear subject to global forces beyond reasonable individual control.

The DEPM's natural behavioral incentives are quite different. In this case, the department is seen as the focal point of both the projection and, by implication, planning strategies. The pool of students individual departments are now concerned with is that of potential students, in the relevant higher-education region, contem-

plating formal training. Quality of education, placement prospects, relative tuition are factors which can now be directly related to enrollment and controlled in the attainment of institutional and department goals (See (14).)

## II. THE MODEL

### A. ECONOMIC FOUNDATIONS

#### 1. Labor Markets

From an economic point of view, student enrollment is a manifestation of the process of human capital formation. The process may take place formally in an educational institution, or in on-the-job training programs (See (2) and (12).)

The conceptual foundations of the process of inert or non-human capital formation in the economy may be applied with minor modifications to describe the formation of human capital in terms of knowledge or skills. At any point in time, the demand for the services of college-trained workers places an upper boundary on the returns to be expected from investment in education (See (4).) Just as in the case of demand for non-human capital services, employers must make a judgement with respect to the profitability of various production alternatives in the use of human capital. The mix of capital services and other production inputs to be used depends entirely on their relative costs. Whether any particular unit of goods or services is to be produced with skill-intensive, or machine-intensive methods depends on the cost of skilled labor relative to those of machine

inputs (See (4),(8), and (18).)

On the other hand, the supply of college-trained graduates places a lower boundary on the returns the educated work force will expect from employment in various occupations. Again, as in the case of the supply of any other factor of production, its supplier -- the worker considering training -- must make an evaluation of the returns associated with the acquisition of knowledge, both pecuniary and psychic, relative to the costs entailed in this investment. In other words, college-enrollment represents an input in the human capital investment process which, like any other investment requires time and other resources for development (See (2).)

To summarize these relationships, we can say that occupational demand factors as well as worker evaluations of the worth of formal training interact in the determination of enrollment -- or output-employment derived demand for formal training. Technically, enrollment is a demand derived from that for goods and services towards the production of which human capital makes some contribution.

2. Educational Markets

The consumer's purchase of "X" as opposed to "Y" goods and services can be largely explained as a process of rational selection. Constrained by the limitations of his budget, the ideal economic consumer is assumed to seek to maximize his satisfactions by employing some combination of objective evaluation and subjective preference in his

purchasing decisions. The purchase of education obviously involves the consumer (student) in a series of similar decisions. Relative tuition rates and fees, indicators of the quality and style of instruction, and other institutional characteristics can be expected to influence the students' choice of college, controlling in turn the institutional share of academic program graduation flows.

Institutions may influence considerably the outcome of the process just described. For example, variations in tuition rates and fees, financial aid, faculty hiring practices, class size and instructional methodology, relative to those of other institutions, may have a direct impact on academic program shares. From an economic point of view, students are expected to compare the costs of enrolling in any specific program offered by a number of institutions with the probable benefits that may be derived from this choice. It should be remembered, however, that given the varied occupational potential and academic requirements of the various programs, university-wide changes may have differing degree program impact. For instance, a given change in tuition and fees will not affect all academic departments alike, each program will be associated with a unique set of decision making factors.

Enrollment in any specific degree program at any particular point in time reflects graduation flows expected over a number of years. In the initial years of college,

variations in the student's occupational expectations, an institutionally-controlled variable, may exert a large influence over attrition and academic accession rates. However, as student investments in a particular degree program increase with time, it becomes relatively unprofitable either to enroll elsewhere or "drop out" (See (10), pp. 65-70.) When the training process nears maturity, intra-institutional, rather than inter-institutional movements are likely to be observed. The common institutional practice of limiting the number of transfer credits allowed tends to reinforce these patterns. Thus, in the absence of drastic changes in relative occupational prospects or academic policies, enrollments will bear a stable relationship with respect to expected graduation flows.

B. THE ECONOMETRICS OF THE DEPM

1. The current version of the model, DEPM 5 has been developed as a recursive system of four behavioral, one-trend, and one policy or control equations for each program or department of instruction. Restrictively, each department's direct enrollments are assumed to be independent from the others. As it will be discussed below, this assumption of block independence is of course convenient but temporary. Investigation of the existing block interdependence among departments will reduce confounding effects and indeed ranks high in our future research agenda.

Table I summarizes the departmental block of equations developed in the DEPM 5.1 version of the model. Essentially, the structural detail attempts to capture the empirical outlines of two markets: (a) the labor market for the services of graduates as they relate to specific occupational groupings, and (b) the "institutional market" for higher education training.

The "labor-market" equations, (1) and (2) attempt to model the occupational demand and corresponding supply adjustments respectively. As shown in Figure 2, which illustrates graphically the relationships involved in equation (1), the output demand vector ($x_t$) influences occupational net accessions ($O_{it}$) as required by labor input vectors ($\tilde{\ell}_i$). Figure 3 simply shows that the relationship between degrees conferred ($P_{it}$) and net accessions can be estimated as a relatively stable function of relative wages $w^*_{it}$, conditioned by cyclical economic developments d, and other -- probably social -- factors captured by a time trend (t). It may be worth noting in passing that the use of census ratios, in order to derive the fraction of net accessions associated with the various levels of higher education training, will also tend to influence the trend coefficients, as the graduate to undergraduate net accession flows change through time.

The "institutional-market" equations (5) and (6) reflect supply/demand departmental adjustments and their corresponding

## TABLE 1

Econometric Structure of DEPM 5.1
Specific Institution/Specific Department/Specific Region

| MARKET | EQUATION # | EQUATION TYPE | | |
|---|---|---|---|---|
| | | BEHAVIORAL | TREND | CONTROL |
| A. Labor Market | (1) | $O_{it} = (\chi_o' \tilde{\ell}_i)(1+g)^t$ | | |
| | (1a) | $g_i = ((\chi_T' \tilde{\ell}_i / \chi_o' \tilde{\ell}_i) - 1)^{1/T}$ | | |
| | (2) | $(P_{it} - \rho O_{it}) = f_i(W^*_{it}, d, t)$ | | |
| | (3) | $w^*_{it} = g_i\ (w^*_{i,t-\theta}, t)$ | | |
| B. Institutional Market | (4) | | | $RT_{it} = h_i(RT_{it-\theta}, t)$ |
| | (5) | $S_{jt} = k_j(RT_{jt-\theta}, RSA_{jt-\theta})$ | | |
| | (6) | $R_{jt} = m_i(\Sigma\delta_{jj}\ (P_{i,t+j} S_{j,t+j})$ | | |

ADDITIONAL SYMBOLS:

$\chi'_j$ = Vector of change in product flows at time j (j=o, origin; j=T, time horizon)

$\tilde{\ell}_i$ = Vector of fixed output-labor requirement coefficients for the ith occupation.

$g$ = Rate of growth in net ith occupational accessions between time o and T.

$\rho$ = Accessions/degrees conferred adjustment coefficient.

9.

$w^*_{it}$ = Relative wage offered for ith occupation during t.

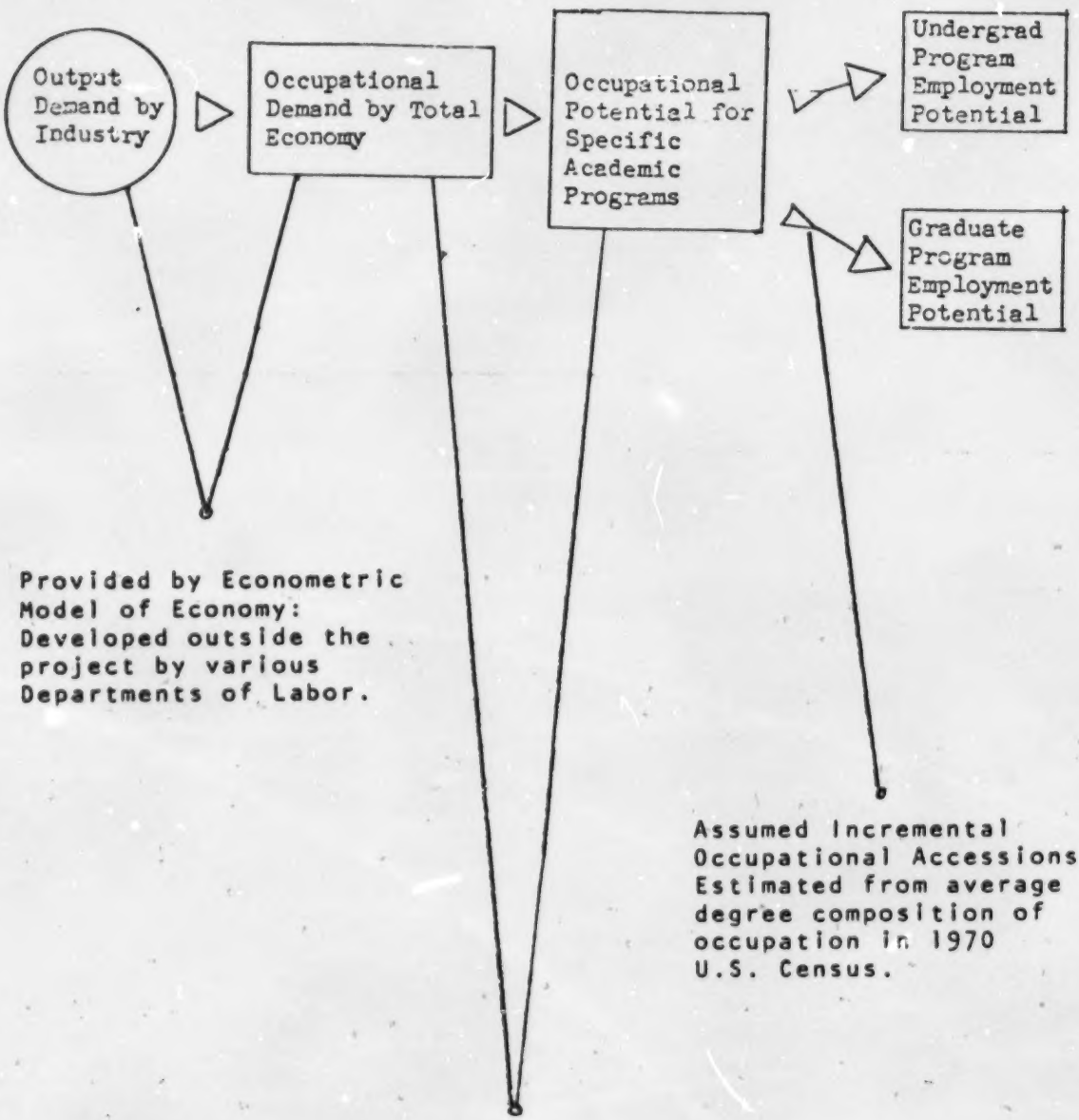
$S_{jt}$ = Share of degrees conferred in the jth department of instruction.

$RT_{jt}$ = Relative tuition for the jth department during t.

$RSA_{jt}$ = Relative scholastic achievement test average for the jth department during t.

DEMAND

Figure 1. Economic Activity and Specific Academic Programs

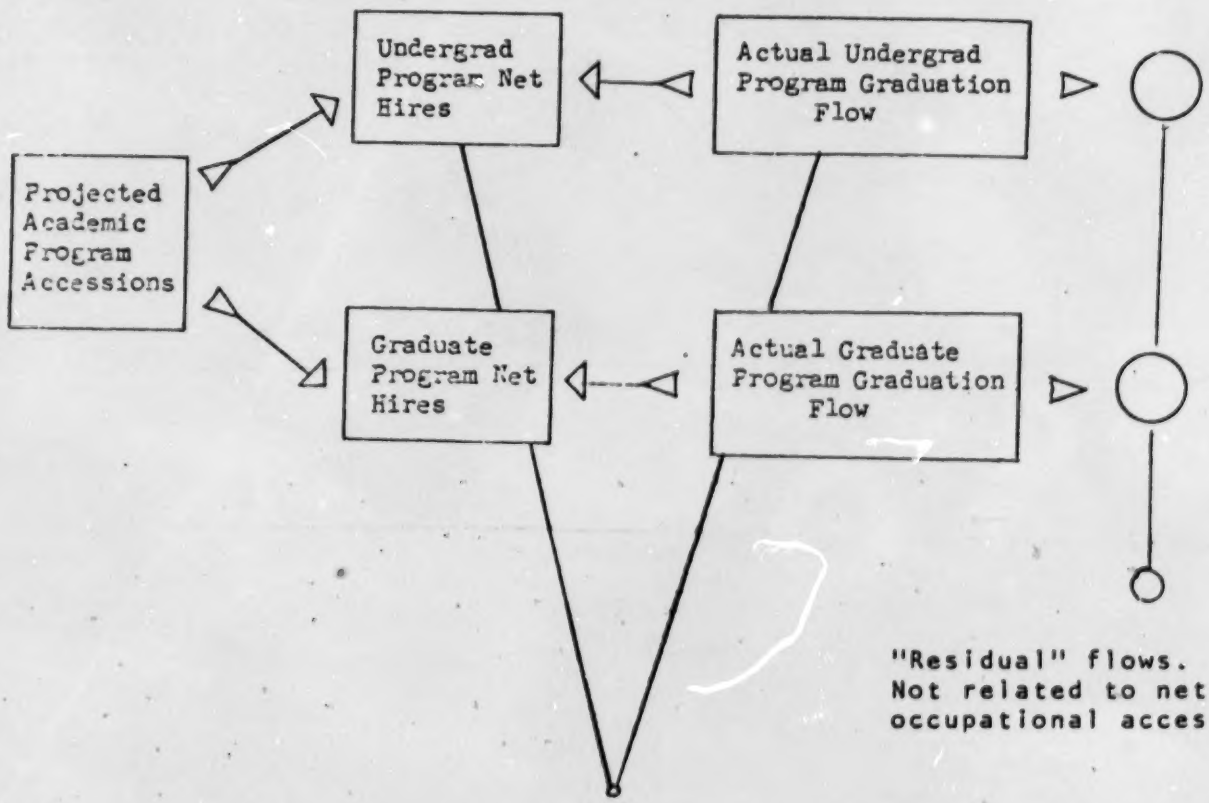

Output Demand by Industry
Occupational Demand by Total Economy
Occupational Potential for Specific Academic Programs
Undergrad Program Employment Potential
Graduate Program Employment Potential
Provided by Econometric Model of Economy: Developed outside the project by various Departments of Labor.
Assumed Incremental Occupational Accessions. Estimated from average degree composition of occupation in 1970 U.S. Census.
Correlation of Academic Discipline and Occupational Titles: Developed by project. (Separate Survey-Research Report completed)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DEMAND | 278 | 278 | 283 | 287 | 292 | 297 | 301 |

## NET ACCESSIONS

## DEGREES CONFERRED RELATIONS

Figure 2. Employment-Graduation Relationships


Undergrad Program Net Hires
Actual Undergrad Program Graduation Flow
Projected Academic Program Accessions
Graduate Program Net Hires
Actual Graduate Program Graduation Flow
"Residual" flows. Not related to net occupational accessions.

Regression Relation between Degrees Conferred and Net Accessions

Versions 1,2,3 : Exponential Specification
Version 4 : Distributed-Lag Specification
Versions 5,6 : Distributed-Lag, Occupational Wage-Effect Specification

Alternative Regional Aggregates



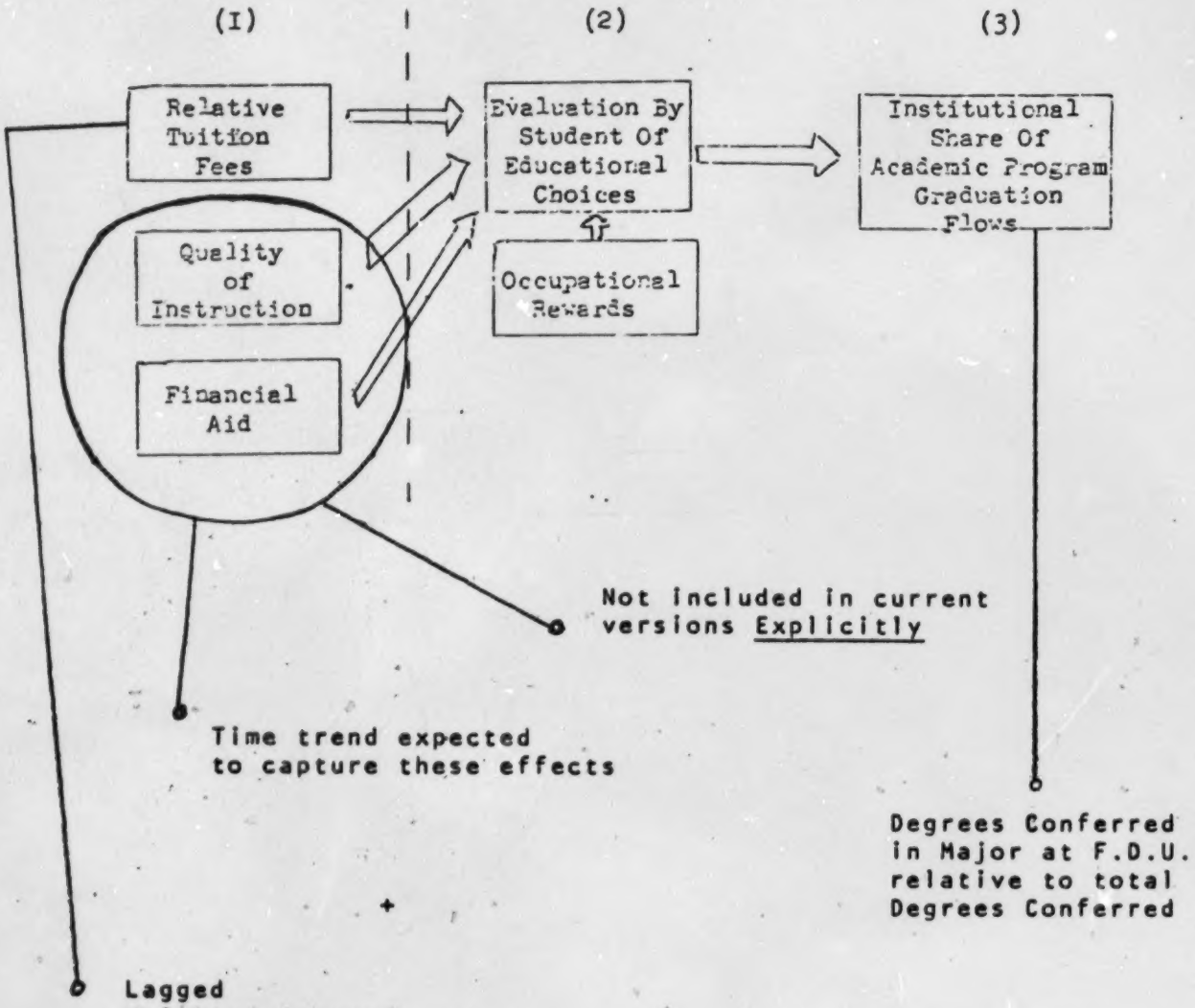
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOT GRAD | 1261 | 1269 | 1457 | 1685 | 1947 | 2251 | 2603 |

institutional enrollment consequences respectively. As shown in Figure 4, the interaction of supply and demand for education implies the determination of shares of degrees conferred in equation (5) in "reduced form", as a function of relative tuition fees, cum and ex financial aid, and quality of instruction. Equation (6) and Figure 5 indicate that current enrollment simply reflect future degrees conferred -- attrition and accretion accounting for the observed discrepancies.

2. In order to appreciate the analytical advantages of the systems approach, it may be well to review an earlier version, the DEPM 3, using a simple diagramatic illustration. The four-quadrant diagram shown as Figure 6 depicts some of the main features of our empirical approach and suggests the immediate decision-making implications flowing from managerial simulation or sensitivity analysis of the DEPM model.

In Figure 6 all coordinates are defined to be positive. The first quadrant reflects the basic net accessions/degrees relation; the second and third quadrants simply express net accessions and institutional shares of degrees conferred as functions of time, and the fourth quadrant is used to derive graphically the number of degrees conferred by a given major by a specific institution at any particular point in time. Take, for instance 1977, a projection year. As indicated by the broken-line extensions of the $D_{it}(\ )$

Figure 3 – Academic-Program Graduation Shares

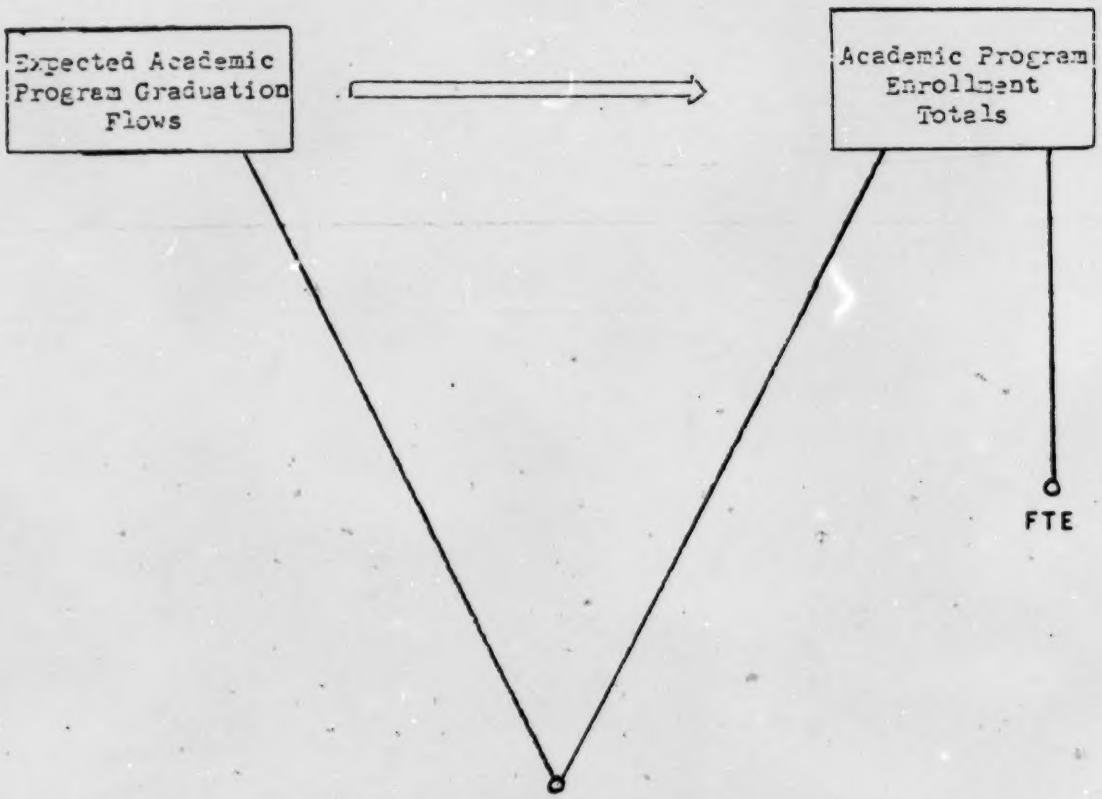

(I)
(2)
(3)
Relative Tuition Fees
Quality of Instruction
Financial Aid
Evaluation By Student Of Educational Choices
Occupational Rewards
Institutional Share Of Academic Program Graduation Flows
Not included in current versions Explicitly
Time trend expected to capture these effects
Degrees Conferred in Major at F.D.U. relative to total Degrees Conferred
Lagged Weighted Average: Weights proportional to number of public and private institutions offering Major

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FDU GRAD | 330 | 329 | 415 | 519 | 646 | 799 | 984 |
| SHARE OF GRAD | .2617 | .2617 | .2850 | .3084 | .3317 | .3550 | .3784 |

## DEGREES CONFERRED FALL-ENROLLMENT

## FTE (FT=1; PT=1/2) RELATIONSHIPS

Figure 4 - Institutional Enrollment-Graduation Ratios

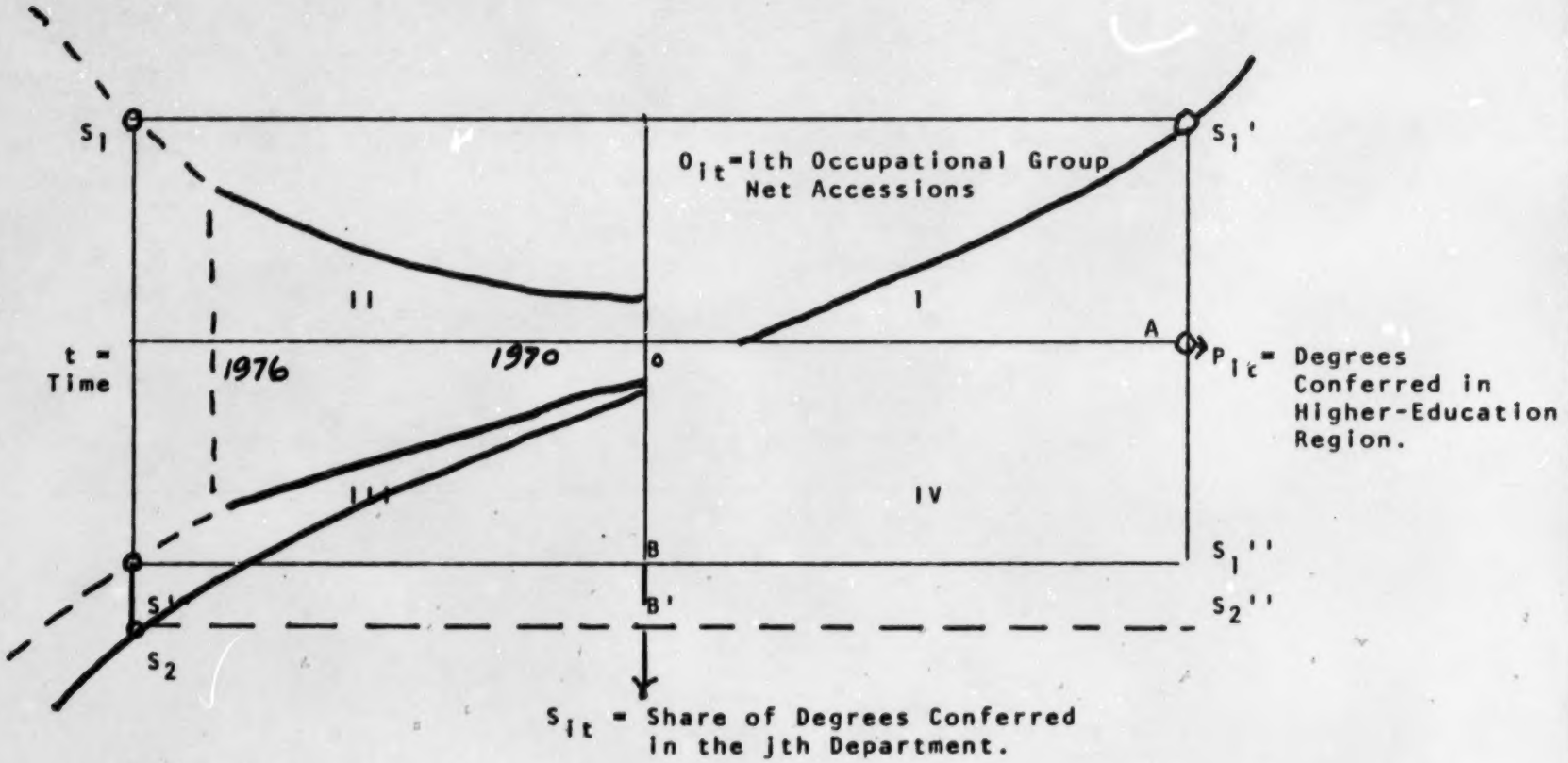



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FDU ENROLL | 1123 | 1122 | 1225 | 1350 | 1501 | 1685 | 1906 |
| RETENTIVE | | | | | | | |
| TUITION | 1.5776 | 1.5776 | 1.5777 | 1.5779 | 1.5780 | 1.5781 | 1.5783 |
| FIRST YR | | | | | | | |
| ACCESSION | -2 | -2 | -2 | -2 | -3 | -4 | -5 |
| SECOND YR | | | | | | | |
| ACCESSION | 147 | 147 | 147 | 178 | 216 | 262 | 316 |
| THIRD YR | | | | | | | |
| ACCESSION | -42 | -42 | -50 | -61 | -74 | -89 | -107 |

15.

FIGURE 5

The DEPM System: Simplified Diagram



and $S_{jt}(\ )$ schedules, it is expected that during that year net accessions into occupations related to the jth major will amount to $S_1$. Concurrently, the share of degrees conferred accounted by the institution under study is projected to be $S_1$". Consequently, extending the corresponding coordinates into the fourth quadrant, we can derive the total number of degrees conferred in the jth major as the area of the ($S_1$"BOA) rectangle -- $Q_{it}=S_{it}xP_{it}$, where $Q_{it}$ = degrees conferred by a specific institution in the ith major, during time t.

If any particular factor assumed constant in this model, were to be varied, the simultaneous impact on $Q_{it}$ could be graphically derived in a straightforward manner. Say, for instance, that relative net tuition were to be decreased, the $S_{it}(\ )$ schedule would then shift downwards, as indicated by the arrows in the third quadrant of Figure 6. The area of the resulting rectangle in the fourth quadrant would then increase, as shown, to ($S_2$"B'OA). This simple sensitivity exercise can be repeated under any set of hypothesized conditions, to conceptualize the impact of policy changes on crucial projection or other system variables.

## III. PLANNING SIMULATION IN ACTION

### A. PREREQUISITES: MODEL, PERTINENT DATA, POLICY AND PROJECTION ASSUMTPIONS

1. A number of crucial ingredients are necessary in order to derive planning simulations of direct department

enrollment totals at the undergraduate and graduate levels. The conceptual model sketched in Section II provides only the roughest of the empirical guides. Indeed, conceptual refinements must go hand-in-hand with judicious empirical choices. Just as the econometric concepts were momentarily restricted from the sake of research effectiveness, the data concepts were also tailored to suit this purpose. For instance, the important problem of segregating part from full-time students was handled through the definition of full-time-equivalent units (FTE) -- an empirical compromise. The next stage of research in this area will probably involve the separate modeling of these two enrollment segments; however, at this stage the bias introduced by our methodology can be inferred by means of sensitivity analysis and eliminated as further research is undertaken on the postulated expanded models.

2. Table 2 provides a summary of the data concepts and sources of information used in the DEPM 5.1. This information should be regarded as an integral part of the econometric structure tested and used in the projections as well as an expression of the temporary empirical compromise reached at this particular juncture in our investigation.

3. Economy-wide variables, not subject to institutional control, -- technically called exogenous -- must be projected, in order to determine the path of the system-

determined or endogenous variables, the final outcome being conditional on the trajectory of policy or control variables. Specifically, in the DEPM 5.1 summarized in Table 1, enrollment and degrees conferred predictions are affected by such exogenous variables as net occupational accessions, relative wages, and cyclical economic fluctuations. In addition, these projections are ultimately conditioned by the course of such policy control variables as relative tuition and average student aptitude test scores.

Significantly, the endogenous variable predictions will also depend on the econometric specifications of the process being analyzed. For instance, equation (1) in Table I may be specified in a number of ways: (a) log-linear, (b) linear, and (c) non-linear. Each of these alternative specifications, as well as any formal restrictions put on the estimating methodologies will materially affect the path of the predicted variables and become important projection assumptions.

B. EFFECT OF SPECIFICATION, EXOGENOUS VARIABLES AND POLICY VARIATIONS

Tables 3 and 4, reproduce a selected sample of sensitivity or planning simulations. For instance in Table 3, "Estimate 3 Accounting Undergrad" assumes the following exogenous variables: (a) initial, 1976 net accessions of 279 accountants with B.S. degrees in the

19.

TABLE 2

DEPM 5.1 Data Concepts and Sources
Regional Groupings

| VARIABLE SYMBOL | DATA CONCEPT | DESCRIPTION/MAIN SOURCES |
|---|---|---|
| $x'_t$ | Vector of industry Annual Employment Projections in specific industry groupings. | Industry (Establishment) data as projected by various Deparments of Labor. See, for instance, N.J. Department of Labor and Industry, Occupational Employment Projections - 1985, October 1978, pp. 11-13. |
| $\tilde{\ell}_i$ | Specific occupational labor-requirement coefficients. | National occupational staffing patterns. These are variables which are usually modified to reflect specific labor-market area idiosyncracies. See, U.S. Dept. of Labor, BLS, Tomorrow's Manpower Needs, BLS Bulleting 1606, Vol. I-IV, 1969 and various supplements. |
| $P_i$ | Annual flow of degrees conferred in specific programs for the various institutions judgemental higher-education market areas developed). | NCES, Earned Degrees Conferred, U.S. Government Printing Office, Washington, various annual issues. |
| $W_{it}$ | Monthly salary offers for specific program graduates. | National averages, temporarily used as proxies for corresponding local statistics. See College Placement Council, Salary Survey, Bethlehem, Pennsylvania, various periodic issues, and annual summaries. |

TABLE 2 (Continued)

| VARIABLE SYMBOL | DATA CONCEPT | DESCRIPTION/MAIN SOURCES |
|---|---|---|
| $W'_{It}$ | National and Regional professional and administrative pay indices. | These are used to establish relative pay dynamics. See, U.S. Dept. of Labor, BLS, National Survey of Pay, various issues and U.S. Dept. of Labor, BLS, Regional Offices, Regional Survey of Pay, various issues. Also, U.S. Bureau of the Census, CPS, P-60, "Annual...Income", various issues. |
| $W^*_{It}$ | $W^*_{It} = (W_I/W'_{It})$ | |
| d | Index of Cyclical Changes | A number of single-variable choices are available here: dummy variable segregation of regression constant, potential GNP gap, lead/lag indices. See, for instance, Department of Commerce, Business Conditions Digest, various monthly issues. |
| $RT_{Jt}$ | Relative Tuition Changes (cum/ex financial aid) For a specific major, the following definitions apply: | This is a relative index of charges with respect to public and independent institution averages, weighted by the relative number of departments in the higher-education market area offering the same type of program. See, for instance Halstad, K., Department of HEW, NIE, Higher-Education Prices and Price Indices; NCES, Higher Education Basic Student Charges, various issues. In particular, for the area in which the DEPM 5.1 has been tested, see N.J. Dept. of Higher Education, RN79-1, "Tuition and Required Fees...," January 1979. |
| | $RT = W_I \frac{T_{Inst.}}{\overline{T}_{Pr}} + (1-W_I)\frac{T_{Inst.}}{\overline{T}_{Pu}}$ | |
| | $W_I = \frac{\text{No. of private instit.}}{\text{No. of public instit.}}$ | |
| | $T_{Inst}$ = Instit. net charges. | |
| | $\overline{T}_I$ = Average instit. charges i=Pr, Pu. | |
| | $P_r$ = Independent institutions. | |
| | $P_u$ = Public institutions. | |

TABLE 2 (Continued)

| VARIABLE SYMBOL | DATA CONCEPT | DESCRIPTION/MAIN SOURCES |
|---|---|---|
| $R_j$ | Fall enrollment, FTE units. | HEW, NCES, Fall Enrollment in Higher Education, various issues. |
| FTE | $FTE_1$ = (Full time students) + 1/2 (Part time students) | |
| | $FTE_2$ = (Full time students) +e.(part time students) | |
| | e = (Average credit hours taken by part time students/ Average credit hours taken by full time students) | |

State of New Jersey, as predicted by the State's Department of Labor and following the time path described by equation (5) and (b) relative wages follow the trajectory indicated by equation (6). In this simulation, relative tuition, the policy or control variable, is expected to be planned along the exponential trend fitted by equation (1). The resulting conditional institutional degrees conferred and enrollment projections are shown in the third and fifth rows of the table respectively. Table 4 exhibits a simulation which assumes a slightly different rate of growth of net accessions (6). These rates are implicitly contained in the State's Department of Labor occupational projections (G = .0159 and G = .0159639 in projection equation (5) for Estimate 3 and Estimate 4 respectively.)

A large spectrum of planning simulations may be generated as alternative economic scenarios are specified and control variables set to follow various planning paths over the projection period.

## III. MANAGEMENT INNOVATION RESEARCH AND IMPLEMENTATION

### A. PLANNING CONDITIONS AND FACTORS

1. The implementation of management information and decision-making systems is usually faced with the type of inertia any planning-technology innovation encounters. In the first place, a number of factors, such as researcher-user relations (See (3), and (5),) type of top management

ESTINATE 3 ACCOUNTING UNDERGRAD
DEGREE ENROLLMENT PROJECTION MODEL
VERSION 6 - WITH REL. TUITION AND WAGES

TABLE 3

DEPM: PLANNING SIMULATION

| | ACTUAL | PROJECTED | | | | | |
|---|---|---|---|---|---|---|---|
| | 1976 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| DEMAND | 279. | 279. | 283. | 288. | 292. | 297. | 302. |
| TOTAL GRAD | 1261. | 1261. | 1400. | 1553. | 1722. | 1909. | 2115. |
| FDU GRAD | 330. | 330. | 350. | 371. | 392. | 413. | 433. |
| SHARE OF GRAD | .2617 | .2617 | .2503 | .2390 | .2276 | .2163 | .2049 |
| FDU ENROLL | 1123. | 1123. | 1155. | 1186. | 1218. | 1249. | 1278. |
| RELATIVE TUITION CONSTANT | 1.5874 | 1.5874 | 1.5895 | 1.5916 | 1.5937 | 1.5958 | 1.5979 |
| WAGES FIRST YR ACCESSION | 1062. | 999. | 986. | 976. | 971. | 969. | 972. |
| | -6. | -6. | -6. | -6. | -6. | -6. | -6. |
| SECOND YR ACCESSION | 29. | 29. | 29. | 29. | 29. | 28. | 28. |
| THIRD YR ACCESSION | 8. | 8. | 8. | 8. | 8. | 7. | 7. |
| EMPLOYMENT POTENTIAL | .2212 | .2212 | .2024 | .1853 | .1698 | .1556 | .1427 |

---- PROJECTION EQUATIONS ----

(1) RELATIVE TUITION - Z(Y) = EXP( K27 + K17 * Y )
K27= .44758639 K17= 1.3172205E- 3 EXP(K27)= 1.5645314
Adj. R=-.1090752 R^2= .0018323 t VALUES= .14210052 7.1192658

(2) FDU GRAD U/TUITION - Q(Y) = P(Y) * (( K42 + K12*Z(Y+2) + K22*Z(Y+1) + K32*Y) + A9)
K42= 1.05374 K12=-.327278 K22=-.13143 K32=-.0103971 A9= .00572886
Adj. R= .8561868 R^2= .9280934 t VALUES=-8.6497851 -3.1019412 -4.0280423 11.999724

(3) TOTAL GRAD -U/WAGES - P(M) = EXP(K13*M + K23 + K33*Q + K43*LOG(W(M)))*Q(M) + (P1 - P6)
K13= 8.2979311E- 2 K23= .98818429 K33=-6.0341159E- 2 K43=-2.4321317E- 2 P1= 1261 P6= 1339.7756
P1 - P6 = -78.7756 P1/P6 = .94120239
Adj. R= .9917534 R^2= .9958767 t VALUES= 26.91147 34.060747 -5.2923831 -8.3635798

(4) FDU ENROLLMENT - R(M) = (B(1,1)*Q(M+1) + B2*Q(M+2) + B3*Q(M+3) + B(4,1)) * (Y(7,1)/R6)
B(1,1)=-.27512311 B2= 1.3807249 B3= .3884463 B(4,1)= 570.21198 Y(7,1)= 1123 R6= 1107.5081
Y(7,1)/R6= 1.013988 (T VALUES- -1.1121058 3.9074035 1.1037276 8.539958)
ADJ. R= .8808616 R^2= .9404308

(5) DEMAND FOR MAJOR - Q(M) = A * ((1+B1)^4) * ((1+B)^2) * ((1+G)^(M-7))
A= 255 B1= .0146 B= .0159

(6) WAGES FOR MAJOR - W(M) = EXP( K26 + K16*M )
K26=-4.5294803E- 2 K16= 3.9650851E- 3 EXP(K26)= .95571567
Adj. R= .1037125 R^2= .2317535 t VALUES= 1.5534877 -3.5142573

23.

## TABLE 4

## DEPM: PLANNING SIMULATION

ESTIMATE 4 ACCOUNTING UNDERGRAD
DEGREE ENROLLMENT PROJECTION MODEL
VERSION 6 - WITH REL. TUITION AND WAGES

| | ACTUAL | PROJECTED | | | | | |
|---|---|---|---|---|---|---|---|
| | 1976 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
| DEMAND | 279. | 279. | 283. | 288. | 292. | 297. | 302. |
| TOTAL GRAD | 1261. | 1261. | 1400. | 1553. | 1723. | 1910. | 2116. |
| FDU GRAD | 330. | 330. | 350. | 371. | 392. | 413. | 434. |
| SHARE OF | | | | | | | |
| GRAD | .2617 | .2617 | .2503 | .2390 | .2276 | .2163 | .2049 |
| FDU ENROLL | 1123. | 1123. | 1155. | 1186. | 1218. | 1249. | 1278. |
| RELATIVE | | | | | | | |
| TUITION | 1.5874 | 1.5874 | 1.5895 | 1.5916 | 1.5937 | 1.5958 | 1.5979 |
| CONSTANT | | | | | | | |
| WAGES | 1062. | 999. | 986. | 976. | 971. | 969. | 972. |
| FIRST YR | | | | | | | |
| ACCESSION | -6. | -6. | -6. | -6. | -6. | -6. | -6. |
| SECOND YR | | | | | | | |
| ACCESSION | 29. | 29. | 29. | 29. | 29. | 28. | 28. |
| THIRD YR | | | | | | | |
| ACCESSION | 8. | 8. | 8. | 8. | 8. | 7. | 7. |
| EMPLOYMENT | | | | | | | |
| POTENTIAL | .2212 | .2212 | .2024 | .1853 | .1698 | .1556 | .1427 |

---- PROJECTION EQUATIONS ----

(1) RELATIVE TUITION - Z(Y) = EXP( K27 + K17 * Y )
K27= .44758639 K17= 1.3172205E- 3 EXP(K27)= 1.5645314
Adj. R=-.1090752 R^2= .0018323 t VALUES= .14210052 7.1192658

(2) FDU GRAD W/TUITION - Q(Y) = P(Y) * (( K42 + K12*Z(Y+2) + K22*Z(Y+1) + K32*Y) + A9)
K42= 1.05374 K12=-.327278 K22=-.13143 K32=-.0103971 A9= .00572885
Adj. R= .8561868 R^2= .9280934 t VALUES=-8.6497851 -3.1019412 -4.0280423 11.999724

(3) TOTAL GRAD -W/WAGES - P(M) = EXP(K13*M + K23 + K33*Q + K43*LOG(W(M)))*Q(M) + (P1 - P6)
K13= 8.2970273E- 2 K23= .98811339 K33=-6.0332071E- 2 K43=-2.4308227E- 2 P1= 1261 P6= 1339.764
P1 - P6 = -78.764 P1/P6 = .94121054
Adj. R= .9917338 R^2= .9958669 t VALUES= 26.881643 34.02427 -5.2862995 -8.3507274

(4) FDU ENROLLMENT - R(M) = (B(1,1)*Q(M+1) + B2*Q(M+2) + B3*Q(M+3) + B(4,1)) * (Y(7,1)/R6)
B(1,1)=-.27514488 B2= 1.3809206 B3= .3879559 B(4,1)= 570.31114 Y(7,1)= 1123 R6= 1107.5298
Y(7,1)/R6= 1.0139682 (T VALUES= -1.1125535 3.9090691 1.1029675 8.5472116)
ADJ. R= .88092 R^2= .94046

(5) DEMAND FOR MAJOR - D(M) = A * ((1+G1)^4) * ((1+G)^2) * ((1+G)^(M-7))
A= 255 G1= .0146 G= .0159639

(6) WAGES FOR MAJOR - W(M) = EXP( K26 + K16*M )
K26=-4.5294803E- 2 K16= 3.9650851E- 3 EXP(K26)= .95571567
Adj. R= .1037125 R^2= .2317535 t VALUES= 1.5534877 -3.5142573

support (See (16),) and organization as well as external environment pressures (See (9)) condition the design of strategies of system adoption. Then, the successful implementation of these strategies is basically determined by the mutual consistency of the various users' goals and with those implicit in the innovation being introduced (See (6).)

2. The DEPM adoption strategy has enjoyed from its very beginning favorable implementation conditions. Further, the model's design criteria were not only econometric, but also managerial, special emphasis was given to the operative aspects of the enrollment planning process. At the project's outset, consultations were held with admissions, finance, placement and institutional research officers, in order to inform them of the DEPM concept and its potential applicability, as well as to elicit their preliminary views and suggestions. This was done with the full cooperation and support of the highest educational executives and a clear understanding that the enrollment process indeed concerns and is affected by a large number of interacting educational decision makers.

B. MANAGEMENT CHANGE

Planning methodologies vary in concept and effectiveness. Although superficially the DEPM appears to spouse

a systems or purely econometric approach to planning, in fact such is not the case. The model is flexible and can entertain any number of special use modifications. In this sense, the model as it evolves has a strongly "behavioral science" content. The users are expected to become involved in the suggestion of further refinements and the model is intended to tackle problems specifically perceived by the concerned decision makers (See (7), and specially (14).)

During the first state of research a number of general features and information needs expressed by the officials interviewed were taken into account in the design of the model. As the project moves into its pretesting phase further adjustments and refinements will be required to accommodate the needs of the users, as they gain experience with the simulation techniques.

The model's usage format is specially conducive to user participation. The DEPM has been developed as a computer interactive program: the user may learn or test the implications of a variety of policy alternatives within a short period of time by simple input changes on his terminal. In order to enlarge the computer-system independence of the methodology, the model has been also adopted for microcomputer processing.

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